WHAT IS CLAIMED IS

1. An optical recording/reproducing apparatus for recording a sequence of data blocks onto an optical recording medium by using a laser driving current waveform to control emission of a laser beam by a semiconductor laser, and for reproducing the data blocks from the medium, the waveform including a sequence of mark and space data portions each having a data length that corresponds to a multiple of a period of a channel clock based on a recording data modulation method, the optical recording/reproducing apparatus comprising:

a semiconductor laser driver supplying a selected one of a plurality of drive currents, including at least a first-level drive current and a second-level drive current, to the semiconductor laser to control the emission of a laser beam by the laser;

a current driver selectively outputting one of a plurality of increment currents to the laser driver in response to control signals, the plurality of increment currents including a first increment current supplied to the laser driver during an automatic power control process and a second increment current supplied to the laser driver during a special power setting process;

a detection unit detecting a first power sample signal, at a first

sampling point of the waveform, from the laser beam emitted when the first increment current is supplied to the laser driver, and the detection unit detecting a second power sample signal, at a second sampling point of the waveform, from the laser beam emitted when the second increment current is supplied to the laser driver; and

a calculation unit calculating a derivative efficiency of the laser based on the first and second power sample signals detected by the detection unit, so that the drive currents of the laser driver, supplied to the laser, are controlled based on the calculated derivative efficiency.

2. The optical recording/reproducing apparatus according to claim 1, wherein the current driver is configured into an erase-level current driver which selectively outputs one of a plurality of erase-level increment currents to the laser driver in response to erase-level control signals, the plurality of erase-level increment currents including a first erase-level increment current supplied to the laser driver during the automatic power control process and a second erase-level increment current supplied to the laser driver during the special power setting process.

3. The optical recording/reproducing apparatus according to claim 2, wherein the erase-level current driver comprises:

a switch having a first state and a second state, one of which is selected at the switch in response to an erase-level select signal;

a first current source, connected to the switch, which supplies the first erase-level increment current to the laser driver via the switch when the first state is selected; and

a second current source, connected to the switch, which supplies the second erase-level increment current to the laser driver via the switch when the second state is selected.

4. The optical recording/reproducing apparatus according to claim 2, wherein the erase-level current driver is configured so that the first erase-level increment current, supplied from the erase-level current driver to the laser driver, is changed to the second erase-level increment current during a period a space data having a data length larger than a predetermined time is formed on the medium.

5. The optical recording/reproducing apparatus according to

claim 2, wherein the erase-level current driver is configured so that the first and second erase-level increment currents supplied to the laser driver result in first and second erase powers of the laser optical output that are obtained by increasing or decreasing a normal erase power of the laser optical output by a predetermined value.

6. The optical recording/reproducing apparatus according to claim 5, wherein the erase-level current driver is configured so that the first and second erase powers of the laser optical output, which are obtained by increasing or decreasing the normal erase power of the laser optical output by the predetermined value, are included in a proper erase-level rage for the medium.

7. The optical recording/reproducing apparatus according to claim 2, wherein the calculation unit is configured so that, when a difference between a normal erase power sample obtained by the first erase-level increment current and an upper limit of a proper erase-level range for the medium is less than a reference value, the calculation unit calculates a derivative efficiency of the laser based

on the normal erase power sample and an erase power sample that is obtained by decreasing the normal erase power sample by a predetermined value, and when the difference between the normal erase power sample and a lower limit of the proper erase-level range is less than the reference value, the calculation unit calculates a derivative efficiency of the laser based on the normal erase power sample and an erase-power sample that is obtained by increasing the normal erase power sample by the predetermined value.

8. The optical recording/reproducing apparatus according to claim 1, wherein the current driver is configured into a space-level current driver that selectively outputs one of a plurality of space-level increment currents to the laser driver in response to space-level control signals, the plurality of space-level increment currents including a first space-level increment current supplied to the laser driver during the automatic power control process and a second space-level increment current supplied to the laser driver during the special power setting process, the second space-level increment current supplied to the laser driver resulting in a drive current produced by the laser driver, which is equal to a peak-level drive current to the laser.

9. The optical recording/reproducing apparatus according to claim 8, further comprising a bias current source supplying a bias current to the laser driver, wherein the laser driver receives the bias current, supplied by the bias current source, and the selected one of the plurality of space-level increment currents, supplied by the space-level current driver, and the laser driver supplying a sum of the received bias current and the received space-level increment current to the laser as a space-level drive current that results in a space power of the laser optical output.

10. The optical recording/reproducing apparatus according to claim 8, wherein the space-level current driver comprises:

a switch having a first state and a second state, one of which is selected at the switch in response to a space-level select signal;

a first current source, connected to the switch, which supplies the first space-level increment current to the laser driver via the switch when the first state is selected; and

a second current source, connected to the switch, which supplies the second space-level increment current to the laser driver via the switch when the second state is selected.

11. The optical recording/reproducing apparatus according to claim 8, wherein the space-level current driver is configured so that the first space-level increment current, supplied from the space-level current driver to the laser driver, is changed to the second space-level increment current during a period a mark data having a data length larger than a predetermined time is formed on the medium.

12. The optical recording/reproducing apparatus according to claim 1, wherein the current driver is configured into a bottom-level current driver that selectively outputs one of a plurality of bottom-level increment currents to the laser driver in response to bottom-level control signals, the plurality of bottom-level increment currents including a first bottom-level increment current supplied to the laser driver during the automatic power control process and a second bottom-level increment current supplied to the laser driver during the special power setting process, the second bottom-level increment current supplied to the laser driver resulting in a drive current produced by the laser driver, which is equal to a peak-level drive current to the laser.

13. The optical recording/reproducing apparatus according to claim 12, further comprising a bias current source supplying a bias current to the laser driver, wherein the laser driver receives the bias current, supplied by the bias current source, and the selected one of the plurality of bottom-level increment currents, supplied by the bottom-level current driver, and the laser driver supplying a sum of the received bias current and the received bottom-level increment current to the laser as a bottom-level drive current that results in a bottom power of the laser optical output.

14. The optical recording/reproducing apparatus according to claim 12, wherein the bottom-level current driver comprises:

a switch having a first state and a second state, one of which is selected at the switch in response to a bottom-level select signal;

a first current source, connected to the switch, which supplies the first bottom-level increment current to the laser driver via the switch when the first state is selected; and

a second current source, connected to the switch, which supplies the second bottom-level increment current to the laser driver via the switch when the second state is selected.

15. The optical recording/reproducing apparatus according to claim 12, wherein the bottom-level current driver is configured so that the first bottom-level increment current, supplied from the bottom-level current driver to the laser driver, is changed to the second bottom-level increment current during a period a mark data having a data length larger than a predetermined time is formed on the medium.

16. An optical recording/reproducing apparatus for recording a sequence of data blocks onto an optical recording medium by using a laser driving current waveform to control emission of a laser beam by a semiconductor laser, and reproducing the data blocks from the medium, the waveform including a sequence of mark and space data portions each having a data length that corresponds to a multiple of a period of a channel clock based on a recording data modulation method, the optical recording/reproducing apparatus comprising:

a semiconductor laser driver supplying a selected one of a plurality of drive currents, including at least a bias-level drive current and a peak-level drive current, to the semiconductor laser to control the emission of a laser beam by the laser;

a bias-level current driver for selectively outputting one of a plurality of bias-level drive currents to the laser driver in response

to control signals, the plurality of bias-level drive currents including a first drive current supplied to the laser driver during an automatic power control APC process and a second drive current supplied to the laser driver during an automatic current control ACC process; and

a control unit selectively executing one of the APC process and the ACC process on the current driver by supplying the control signals to the current driver, the control unit outputting a sampling signal to the current driver in response to a power-monitor signal of the laser beam emitted by the laser when recording data onto the recording medium,

wherein, when the control unit outputs the sampling signal within a predetermined time, the control unit continuously executes the APC process on the current driver so that the current driver supplies the first drive current to the laser driver, and when the control unit does not output the sampling signal over a period exceeding the predetermined time, the control unit terminates the execution of the APC process and starts the execution of the ACC process by using a switching unit that operates in response to the control signals supplied to the current driver, so that the current driver supplies the second drive current to the laser driver.

17. The optical recording/reproducing apparatus according to claim 16, wherein the semiconductor laser driver is configured to supply a selected one of the plurality of drive currents, including the bias-level drive current, the peak-level drive current and an erase-level drive current, to the semiconductor laser so as to control the emission of a laser beam by the laser.

18. The optical recording/reproducing apparatus according to claim 16, wherein the control unit is configured such that, after the execution of the ACC process is started, the control unit immediately restarts the execution of the APC process.

19. The optical recording/reproducing apparatus according to claim 16, further comprising:

a peak-level current driver outputting a peak-level increment current to the laser driver in response to a peak-level control signal supplied by the control unit; and

an erase-level current driver outputting an erase-level increment current to the laser driver in response to an erase-level

control signal supplied by the control unit

20. The optical recording/reproducing apparatus according to claim 16, wherein the current driver includes a monostable multivibrator that receives the sampling signal output by the control unit, and the multivibrator outputs a control signal to the switching unit.

21. The optical recording/reproducing apparatus according to claim 16, wherein the current driver includes a counter unit having a clock and a counter that receives the sampling signal output by the control unit, the clock outputting a clock signal at a predetermined frequency, and, when the number of the clock signals counted by the counter exceeds a predetermined value, the counter unit outputs a control signal to the switching unit.

22. The optical recording/reproducing apparatus according to claim 16, further comprising a detection unit detecting a first power sample signal at a first sampling point of the waveform from the laser beam emitted when the first increment current is supplied to the laser driver, and the detection unit detecting a second power sample signal at a second sampling point of the waveform from the laser beam emitted when the second increment current is supplied to the laser drive.

23. The optical recording/reproducing apparatus according to claim 22, further comprising a calculation unit calculating a derivative efficiency of the laser based on the first and second power sample signals detected by the detection unit, so that the drive currents of the laser driver, supplied to the laser, are controlled based on the calculated derivative efficiency.

24. The optical recording/reproducing apparatus according to claim 16, wherein the control unit outputs the sampling signal to the current driver when a data length of a space data to be recorded onto

the recording medium exceeds a predetermined time.

25. The optical recording/reproducing apparatus according to claim 16, further comprising:

an erase-level current driver selectively outputting one of a plurality of erase-level increment currents to the laser driver in response to erase-level control signals, the plurality of erase-level increment currents including a first erase-level increment current supplied to the laser driver during the automatic power control process and a second erase-level increment current supplied to the laser driver during a special power setting process;

a detection unit detecting a first power sample at a first sampling point of the waveform from the laser beam emitted when the first increment current is supplied to the laser driver, and the detection unit detecting a second power sample at a second sampling point of the waveform from the laser beam emitted when the second increment current is supplied to the laser driver; and

a calculation unit calculating a derivative efficiency of the laser based on the first and second power sample signals detected by the detection unit, so that the drive currents of the laser driver, supplied to the laser, are controlled based on the calculated derivative efficiency.

26. The optical recording/reproducing apparatus according to claim 25, wherein the erase-level current driver comprises:

a switch having a first state and a second state, one of which is selected at the switch in response to an erase-level select signal;

a first digital-to-analog converter, connected to the switch, which supplies the first erase-level increment current to the laser driver via the switch when the first state is selected; and

a second digital-to-analog converter, connected to the switch, which supplies the second erase-level increment current to the laser driver via the switch when the second state is selected.

27. The optical recording/reproducing apparatus according to claim 25, wherein the erase-level current driver is configured so that the first erase-level increment current, supplied from the erase-level current driver to the laser driver, is changed to the second erase-level increment current during a period a space data having a data length larger than a predetermined time is formed on the medium.

28. The optical recording/reproducing apparatus according to

claim 25, wherein the erase-level current driver is configured so that the first and second erase-level increment currents supplied to the laser driver result in first and second erase powers of the laser optical output that are obtained by increasing or decreasing a normal erase power of the laser optical output by a predetermined value.

29. The optical recording/reproducing apparatus according to claim 28, wherein the erase-level current driver is configured so that the first and second erase powers of the laser optical output, which are obtained by increasing or decreasing the normal erase power of the laser optical output by the predetermined value, are included in a proper erase-level rage for the medium.

30. The optical recording/reproducing apparatus according to claim 25, wherein the calculation unit is configured so that, when a difference between a normal erase power sample obtained by the first erase-level increment current and an upper limit of a proper erase-level range for the medium is less than a reference value, the calculation unit calculates a derivative efficiency of the laser based

on the normal erase power sample and an erase power sample that is obtained by decreasing the normal erase power sample by a predetermined value, and when the difference between the normal erase power sample and a lower limit of the proper erase-level range is less than the reference value, the calculation unit calculates a derivative efficiency of the laser based on the normal erase power sample and an erase-power sample that is obtained by increasing the normal erase power sample by the predetermined value.